



**1 : 600 / 1 : 240**

WELL INFORMATION					
MWD Run Number	100	200			
Date run completed	10-Feb-16	12-Feb-16			
Rig Bit Number	0100	0200			
Bit Size (in)	8.750	8.500			
Tool Nominal OD (in)	6.750	6.750			
Log Start Depth (TVD, ft)	1,954.87	5,590.36			
Log End Depth (TVD, ft)	5,590.36	6,495.22			
Drill or Wipe	Drill	Drill			
Drill/Wipe Start Date and Time	09-Feb-16 15:07	10-Feb-16 16:01			
Drill/Wipe End Date and Time	10-Feb-16 04:33	12-Feb-16 13:52			
Min Inc (deg) @ Depth (TVD, ft)	0.20 @ 2,962.48	10.69 @ 5,596.25			
Max Inc (deg) @ Depth (TVD, ft)	10.38 @ 5,509.74	91.36 @ 6,474.03			
Bit TFA(in2) / Bit Type	1.04 / PDC	0.98 / PDC			
Flow Rate (gpm)	600.00	595.88			
Max AV (fpm) / CV (fpm) @ MWD	473.0 / N/A	549.8 / N/A			
Fluid Type	Diesel Mud Base	Diesel Mud Base			
Density (ppg) / Viscosity (spqt)	9.70 / 46.00	9.80 / 46.00			
Filtrate CL (ppm)	29,000.00	35,000.00			
pH / Fluid Loss (mptm)	N/A / N/A	N/A / N/A			
PV (cP) / YP (lbf2)	15 / 10.00	15 / 10.00			
% Solids / % Sand	12.9 / N/A	11.50 / N/A			
% Oil / Oil:Water Ratio	62.00 / 72:28	66.00 / 76:24			
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Max Tool Temp (in) / S	150.10 / PDM	200.05 / N/A			

Max Tool Temp (degF) / Source	156.13 / PCM	229.65 / HCIM			
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A			
Lead MWD Engineer	Brian Neu	Brian Neu			
Customer Representative	Charles Kendrick	Charles Kendrick			
SENSOR INFORMATION					
Downhole Processor Information					
Tool Type	PCM	HCIM			
Software Version	5.93	88.58			
Sub Serial Number	11404286	11380150			
Insert Serial Number	11400950	11199528			
Date and Time Initialized	09-Feb-16 03:58	10-Feb-16 10:53			
Date and Time Read	10-Feb-16 08:57	12-Feb-16 20:32			
ECMB SW Version	N/A	N/A			
Directional Sensor Information					
Tool Type	PCDC	PCDC			
Distance From Bit (ft)	70.00	36.00			
Software Version	6.33	6.33			
Sub Serial Number	11404286	11677168			
Sonde Serial Number	12174582	11297555			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	132.50	0.00			
Gamma Ray Sensor Information					
Tool Type	PCG	PCG			
Distance From Bit (ft)	63.26	25.00			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11404286	11964672			
Insert/Sonde Serial Number	11579843	11681055			
Pressure Sensor Information					
Tool Type	N/A	PWD			
Distance From Bit (ft)	N/A	44.01			
Recorded Sample Period (sec)	N/A	1			
Software Version	N/A	3.70			
Collar Serial Number	N/A	11661468			
Insert Serial Number	N/A	10815263			
Rotary Steerable Information					
Tool Type	N/A	GP			
Distance From Bit (ft)	N/A	3.20			
Software Version	N/A	7.07			
Sub Serial Number	N/A	0			
Pulser Controller Sensor Information					
Tool Type	PCM	PCM			
Software Version	5.93	8.21			
PIC Software Version	1.70				
Sub/HOC Serial Number	11404286	220316			
Insert/Probe/Module SN	11400950	11680860			
Battery Serial Number	N/A	N/A			
Valve Insert SN	N/A	N/A			

Valve Insert SN	N/A	N/A			
DC Insert Serial Number	N/A	N/A			
Choke Size (32nd)	N/A	N/A			
Driver Current (amps)	N/A	N/A			
Driver SMI Current (amps)	N/A	N/A			
Boot Strap Version	4,146.00	4,146.00			

### DDSr-HCIM Sensor Information

Tool Type	N/A	DDSr-HCIM			
Distance From Bit (ft)	N/A	0.00			
Recorded Sample Period (sec)	N/A	12			
Software Version	N/A	20.88			
Sub Serial Number	N/A	11380150			
Insert Serial Number	N/A	11032891			
Sensor ID Number	N/A	5615			

### DDSr-GP Sensor Information

Tool Type	N/A	DDSr-GP			
Distance From Bit (ft)	N/A	0.00			
Recorded Sample Period (sec)	N/A	12			
Software Version	N/A	30.88			
Sub Serial Number	N/A	446			
Insert Serial Number	N/A	11839439			
Sensor ID Number	N/A	11270			

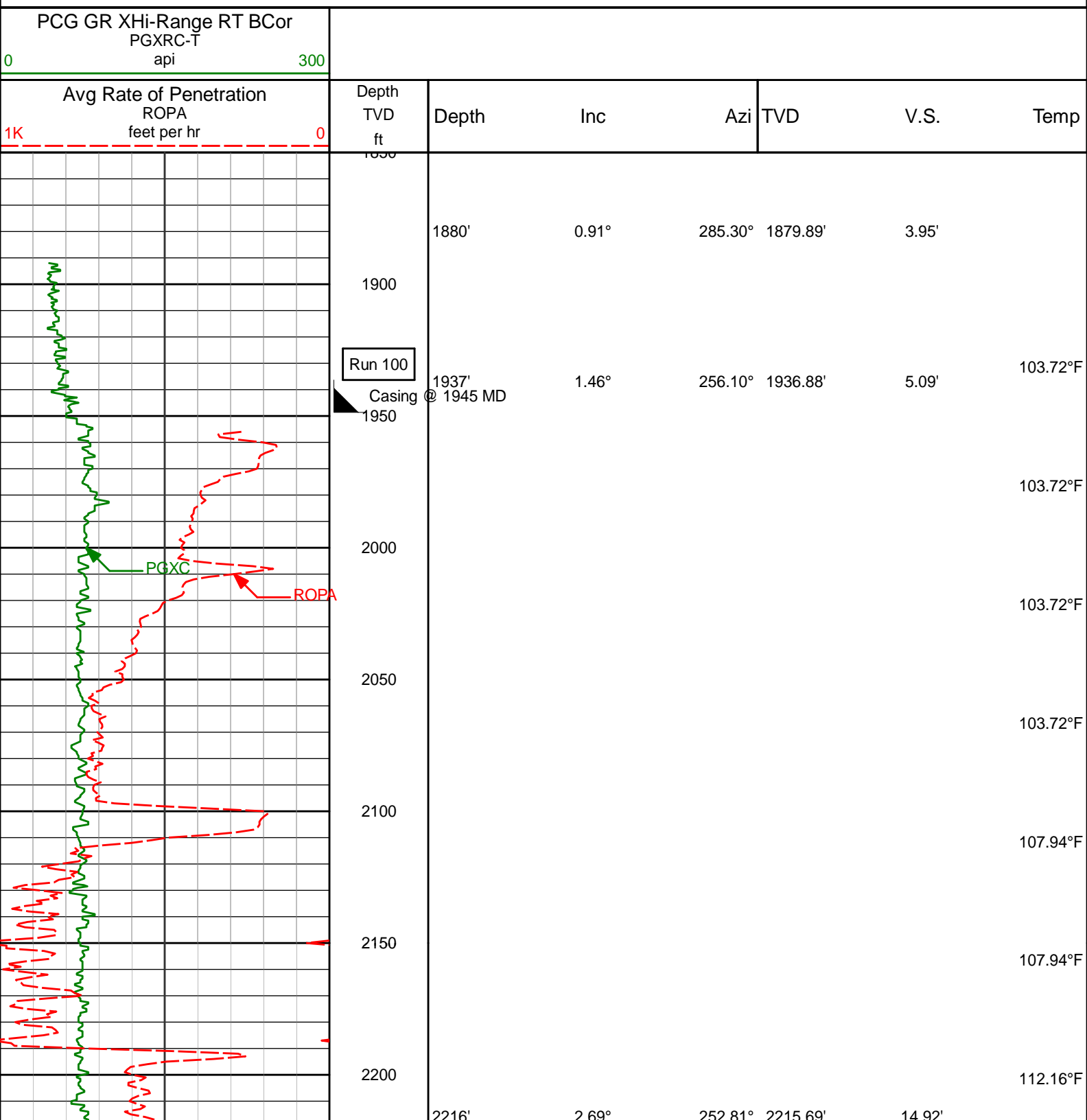
### REMARKS

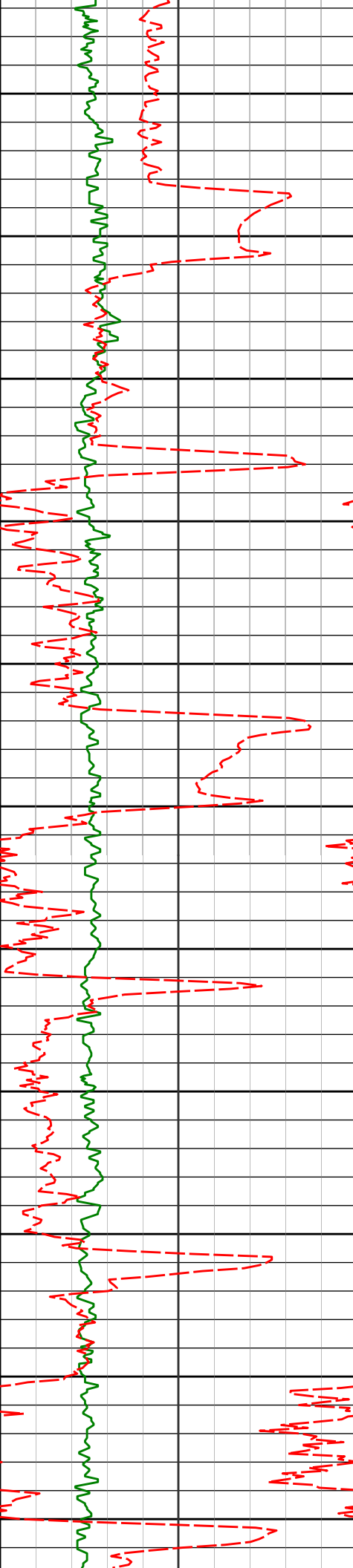
1. All depths are calibrated to driller's pipe tally and are total vertical depth from the drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. The following smoothing parameters have been applied to the data:
  - 1: 600 (2"):
    - Interval: 1.0 ft
    - Coercion Distance: 3.0 ft (ROPA)
    - Interval: 1.0 ft
    - Coercion Distance: 3.0 ft (Gamma Ray)
  - 1: 240 (5")
    - Interval: 0.5 ft
    - Coercion Distance: 1.2 ft (ROPA)
    - Interval: 0.5 ft
    - Coercion Distance: 0.6 ft (Gamma Ray)

### WARRANTY

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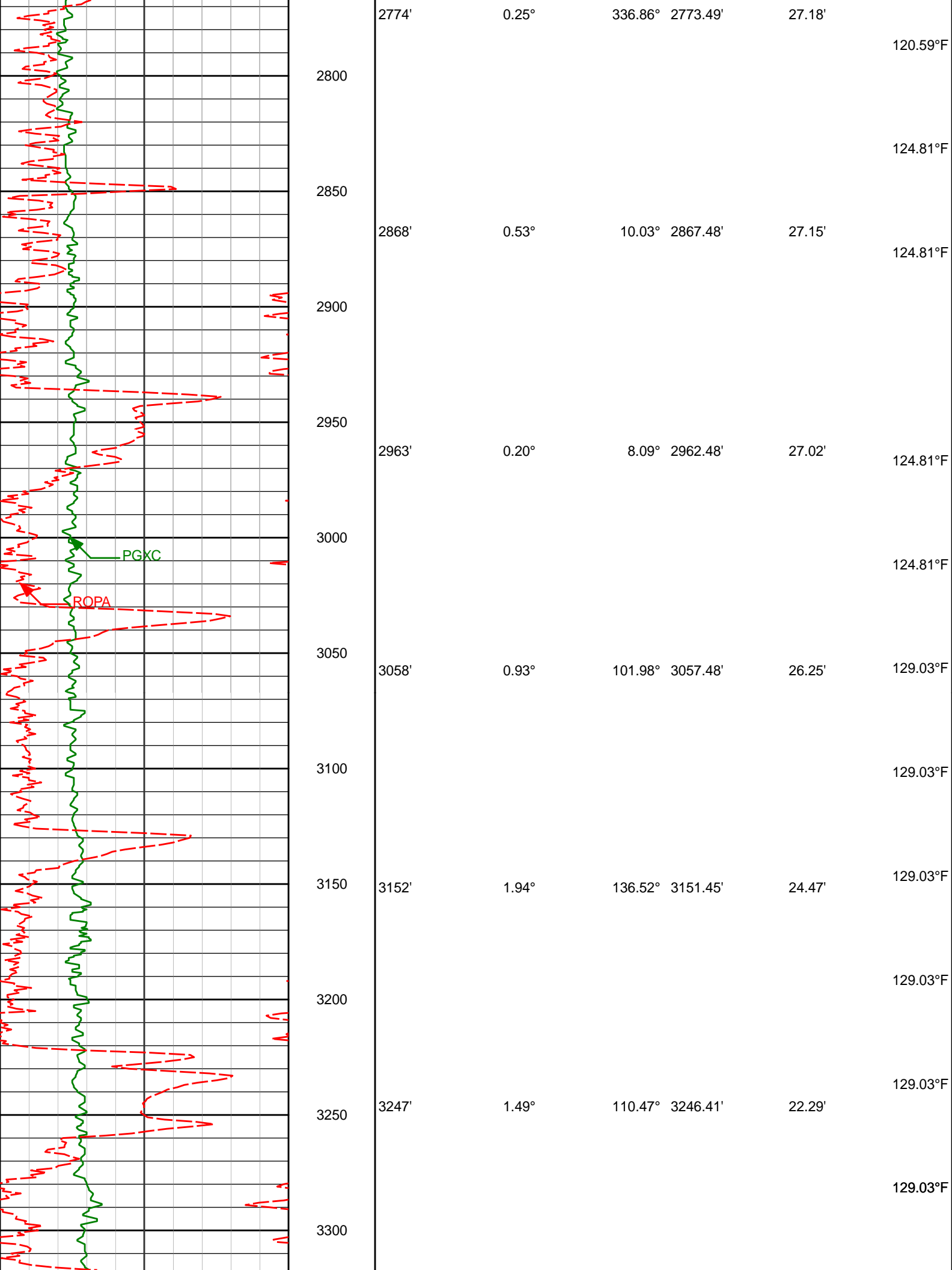
# TVD Detail 1:600 Scale

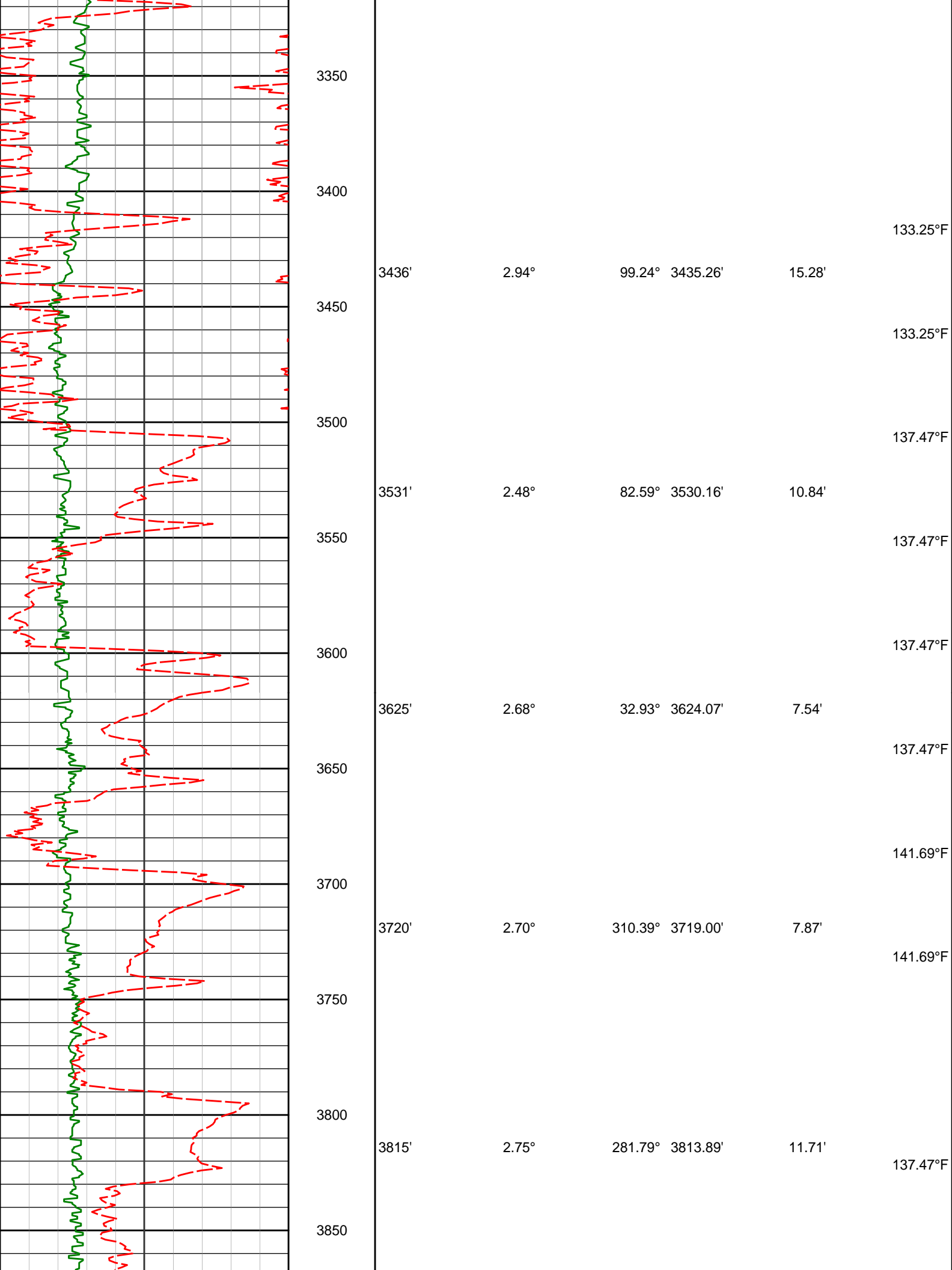


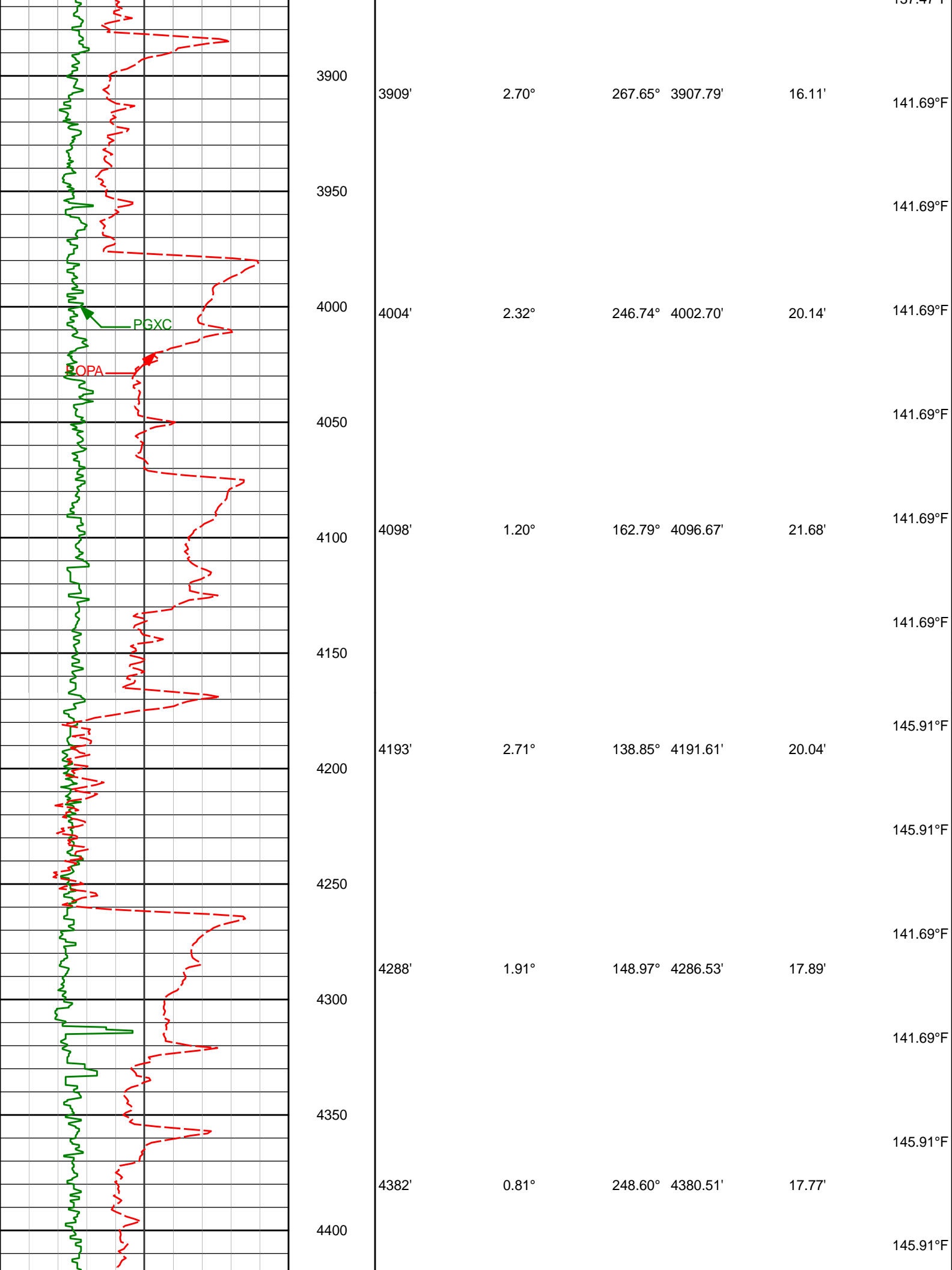


2250  
2300  
2350  
2400  
2450  
2500  
2550  
2600  
2650  
2700  
2750

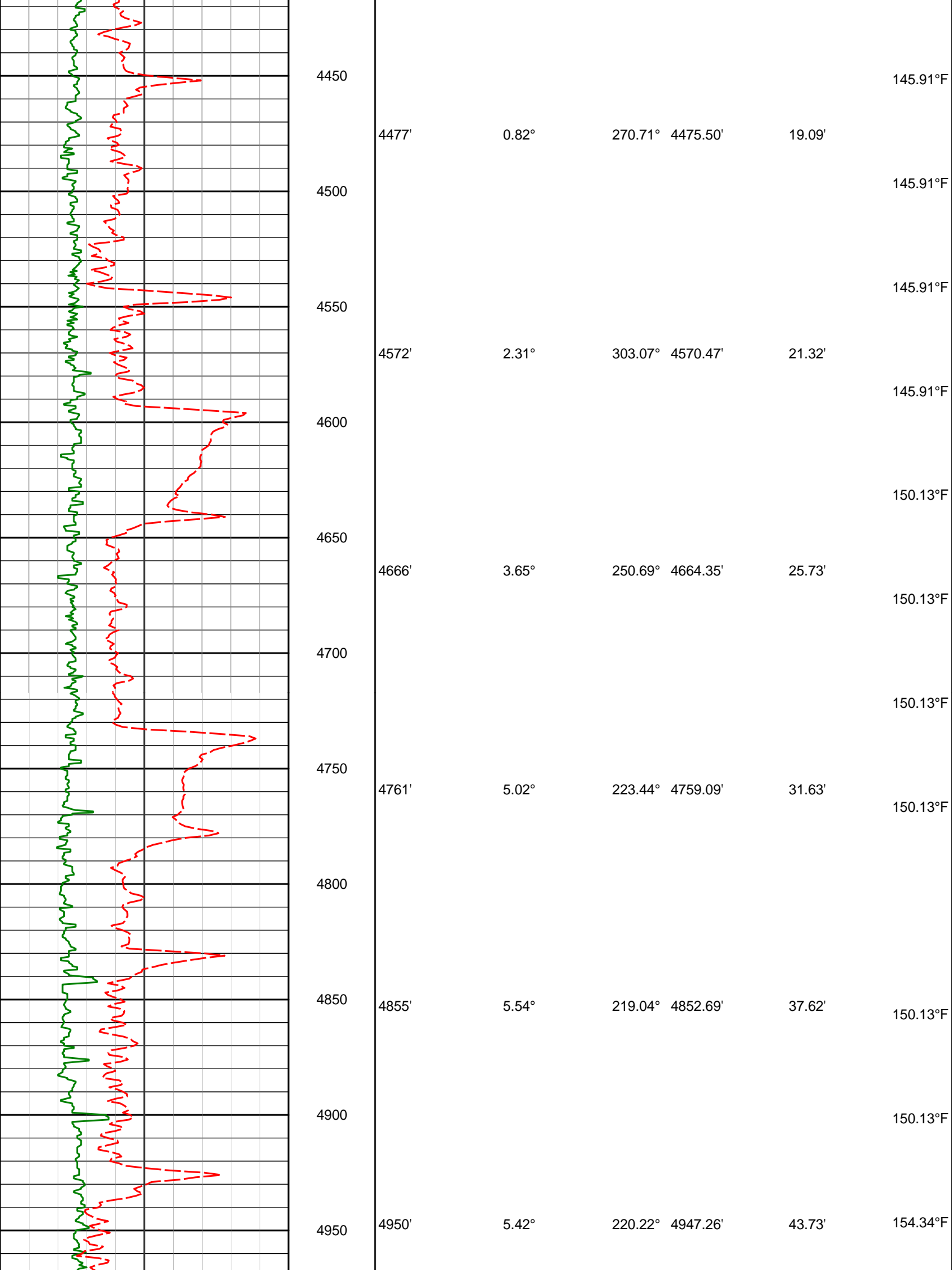
2270'	1.86°	269.85°	2306.62'	18.46'	112.16°F
2307'	1.86°	269.85°	2306.62'	18.46'	116.38°F
2398'	2.47°	268.31°	2397.55'	21.89'	116.37°F
2490'	1.19°	253.91°	2489.51'	24.79'	116.38°F
2680'	0.47°	196.85°	2679.49'	26.97'	120.59°F
					120.59°F
					120.59°F

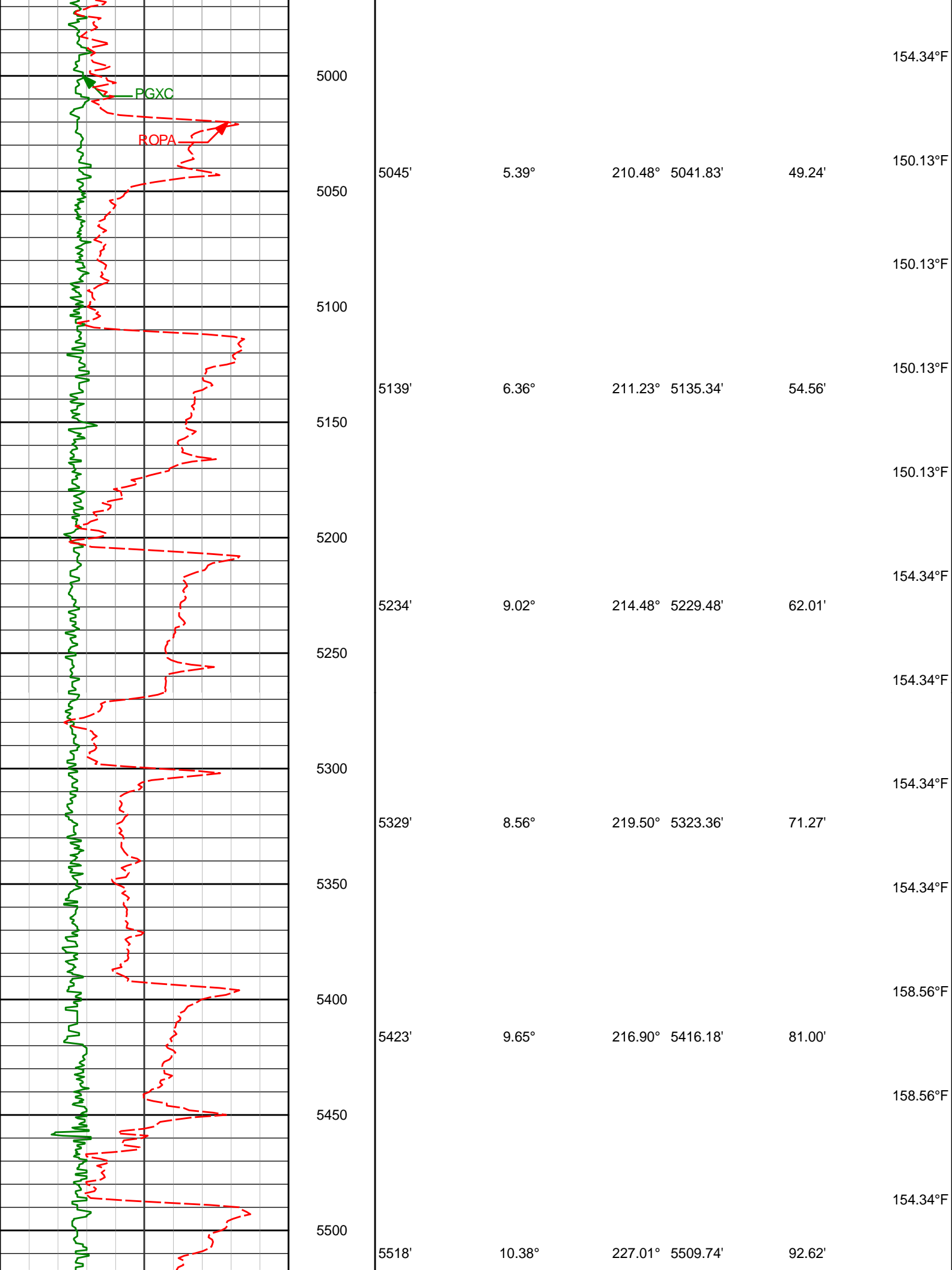


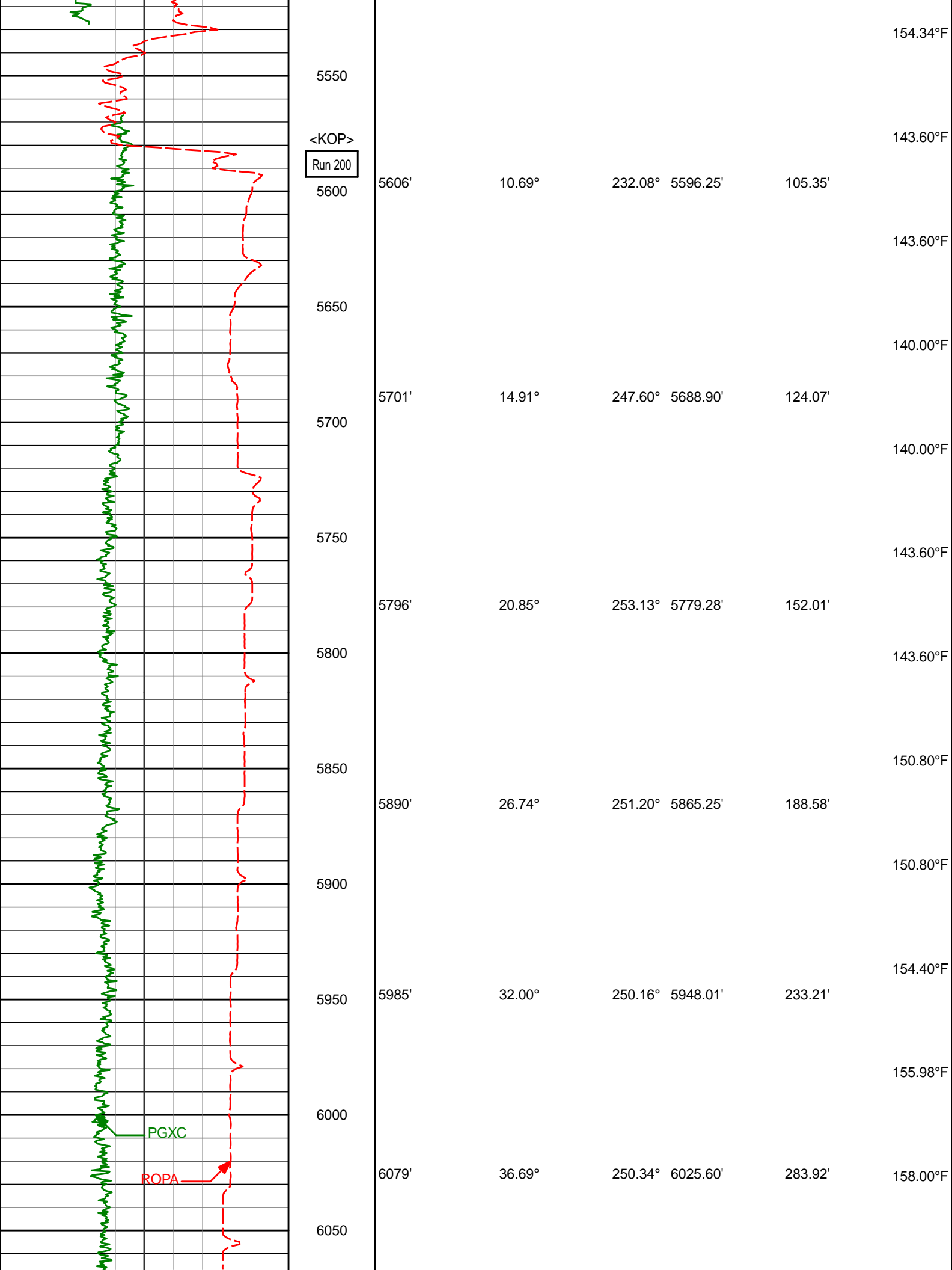






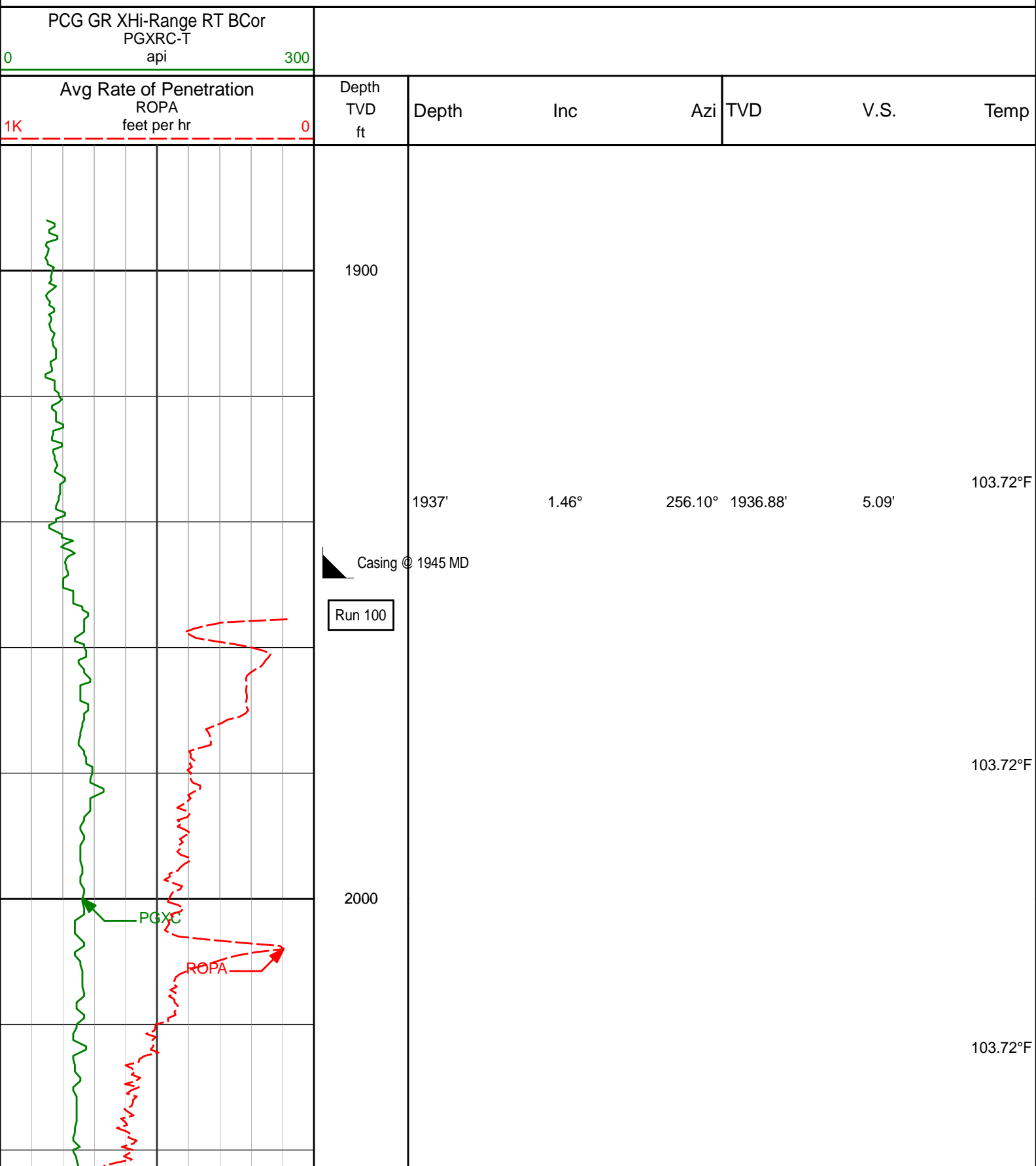


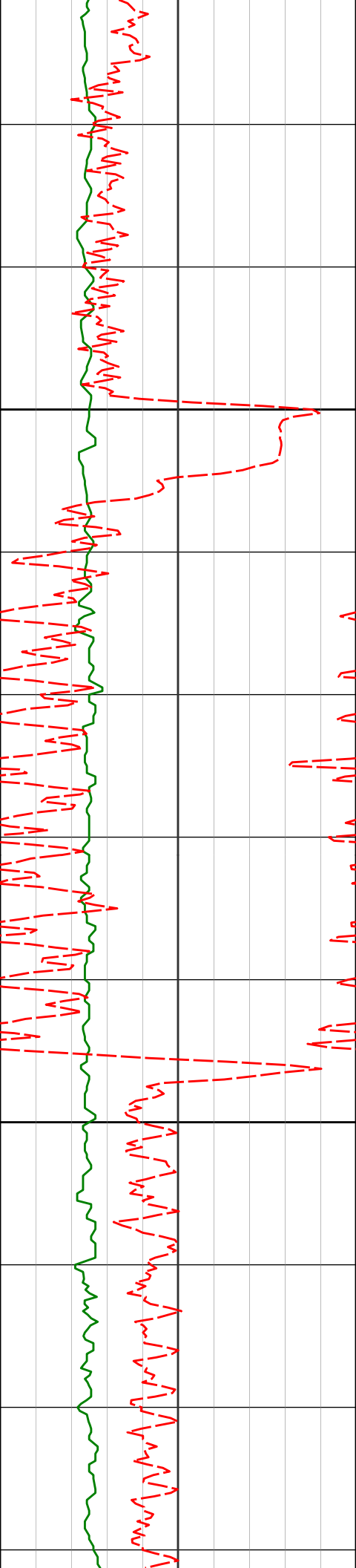






# TVD Detail 1:240 Scale





2100

2200

103.72°F

107.94°F

107.94°F

112.16°F

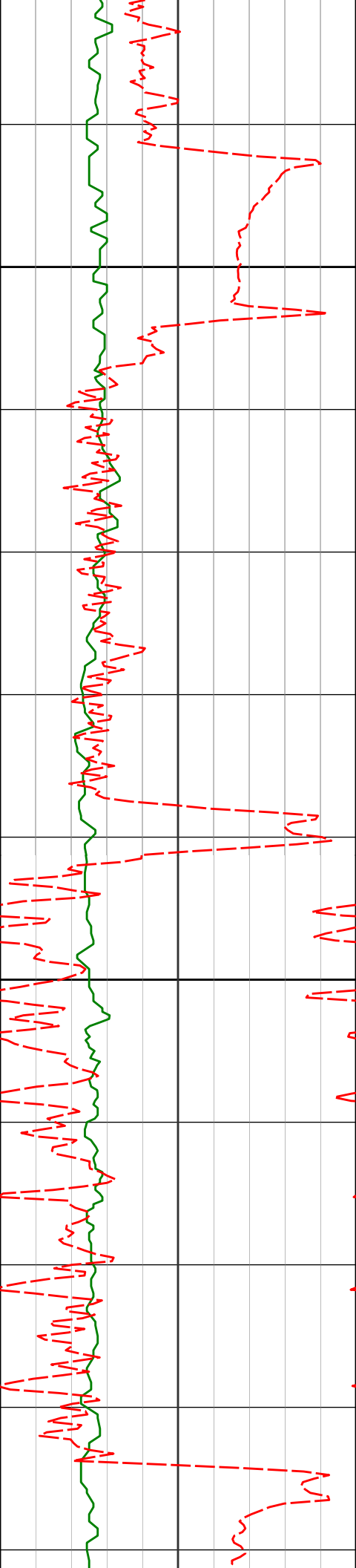
112.16°F

2216'

2.69°

252.81° 2215.69'

14.92'



2300

2307'

1.86°

269.85° 2306.62'

18.46'

116.38°F

116.38°F

116.37°F

2400

2398'

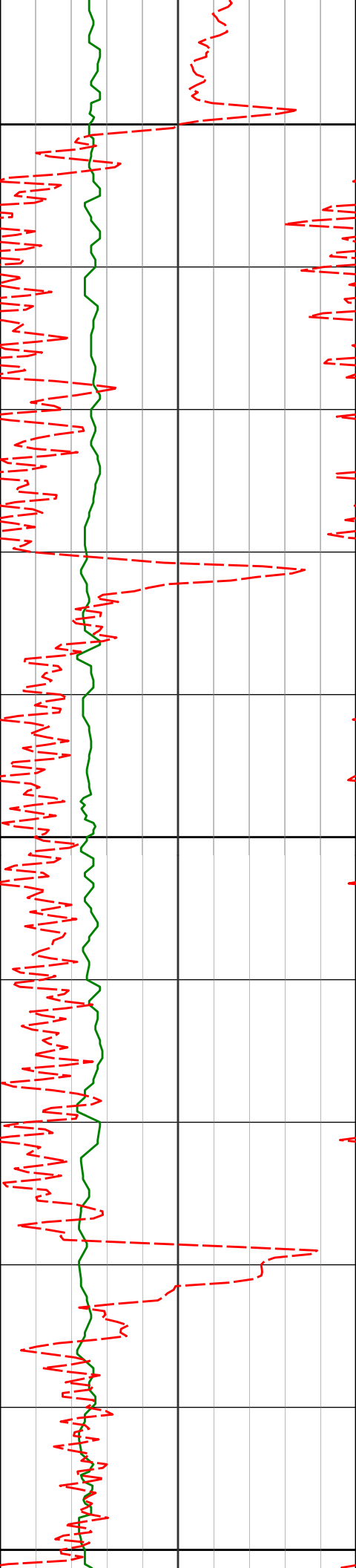
2.47°

268.31° 2397.55'

21.89'

116.37°F

116.38°F



2490'

1.19°

253.91° 2489.51'

24.79'

2500

116.38°F

116.38°F

2600

116.38°F

120.59°F

2680'

0.47°

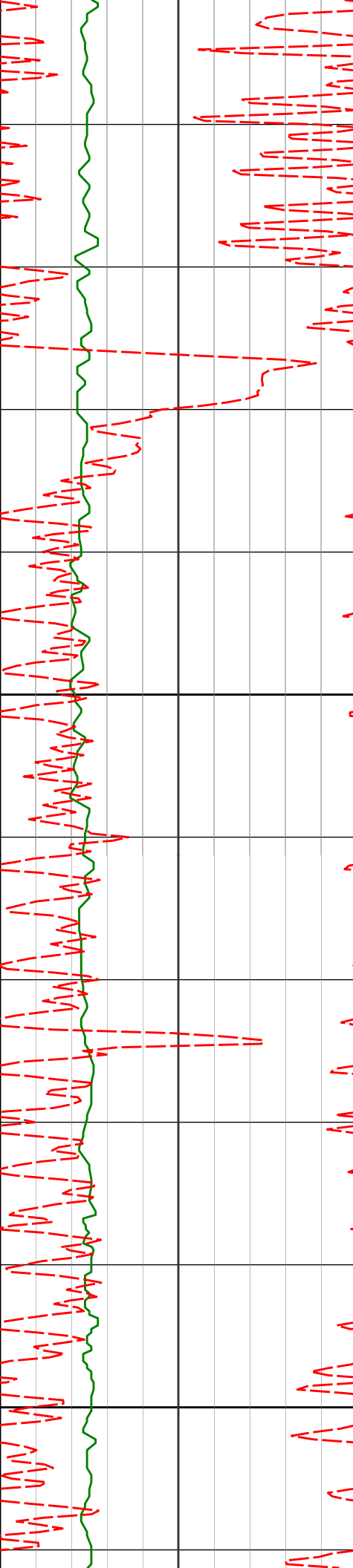
196.85° 2679.49'

26.97'

2700

120.59°F





2800

2900

2774'

0.25°

336.86° 2773.49'

27.18'

2868'

0.53°

10.03° 2867.48'

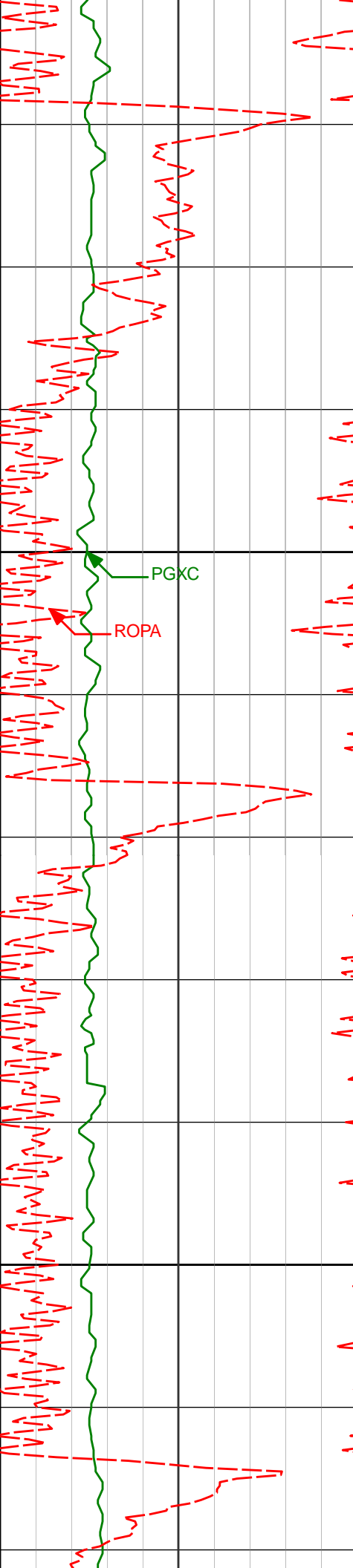
27.15'

120.59°F

120.59°F

124.81°F

124.81°F



3000

3100

2963'

0.20°

8.09°

2962.48'

27.02'

124.81°F

124.81°F

3058'

0.93°

101.98°

3057.48'

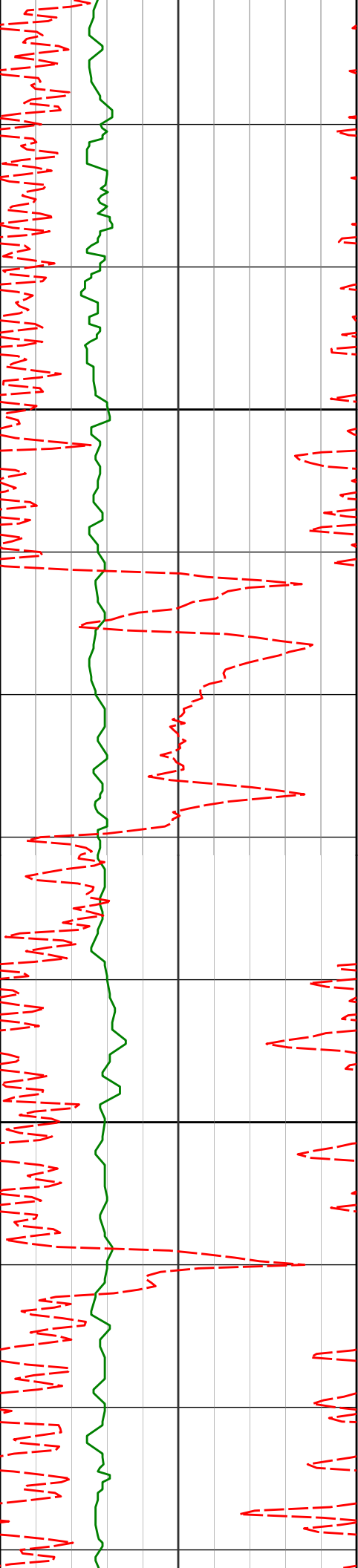
26.25'

129.03°F

129.03°F

PGXC

ROPA



3152'

1.94°

136.52°

3151.45'

24.47'

129.03°F

3200

129.03°F

3247'

1.49°

110.47°

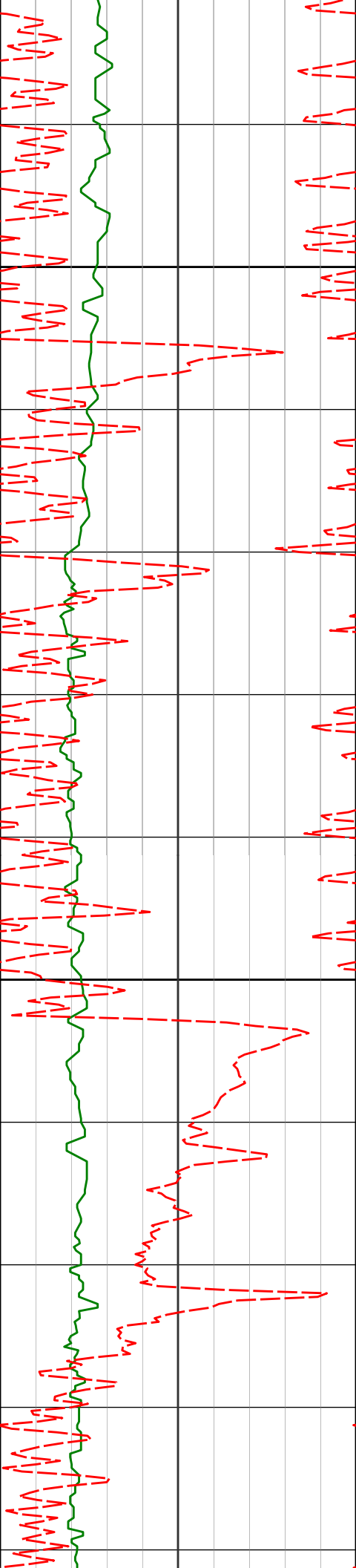
3246.41'

22.29'

129.03°F

3300

129.03°F



3400

3436'

2.94°

99.24°

3435.26'

15.28'

133.25°F

133.25°F

3500

3531'

2.48°

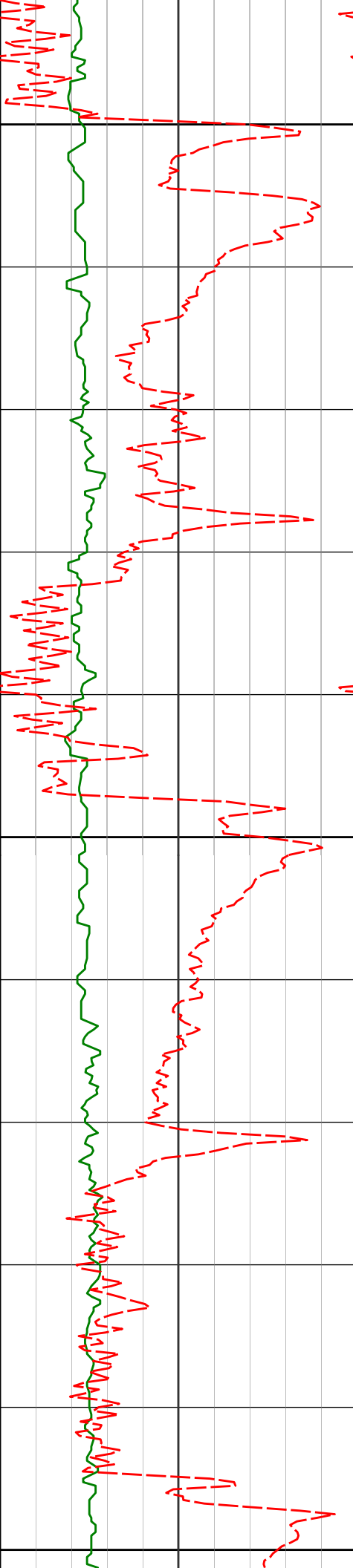
82.59°

3530.16'

10.84'

137.47°F

137.47°F



3600

3625'

2.68°

32.93°

3624.07'

7.54'

3700

3720'

2.70°

310.39°

3719.00'

7.87'

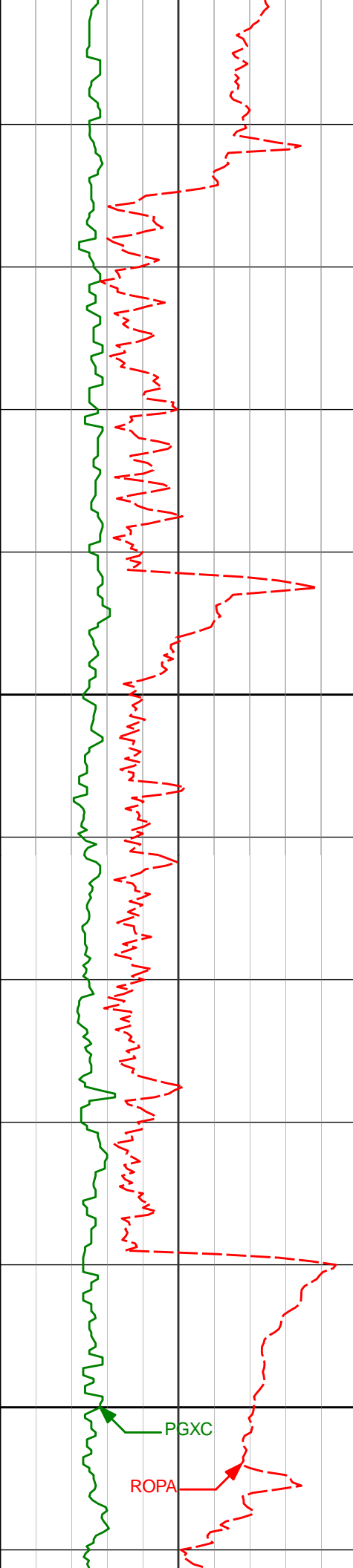
3800

137.47°F

137.47°F

141.69°F

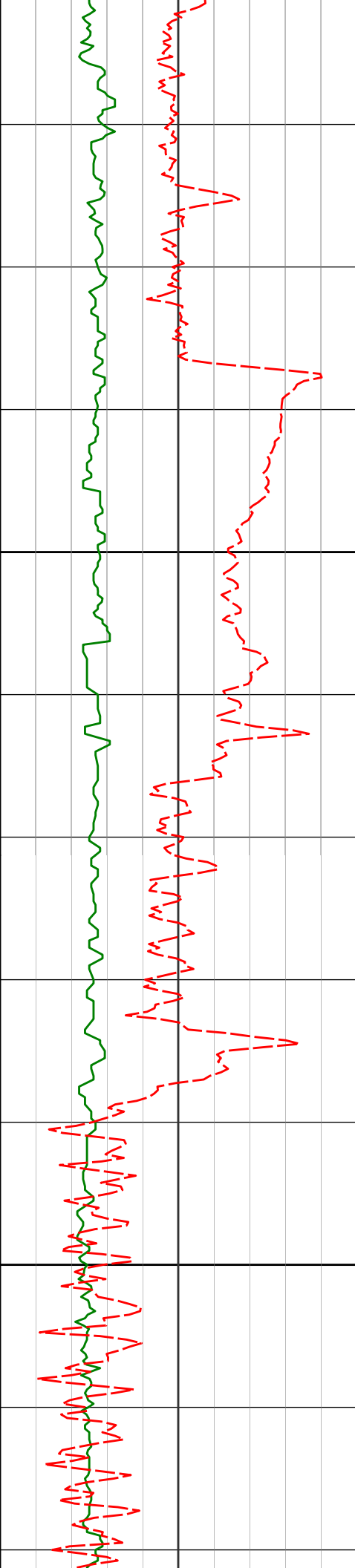
141.69°F



3815'	2.75°	281.79°	3813.89'	11.71'	
					137.47°F
					137.47°F
3900					
3909'	2.70°	267.65°	3907.79'	16.11'	
					141.69°F
					141.69°F
4000					
4004'	2.32°	246.74°	4002.70'	20.14'	
					141.69°F

PGXC

ROPA



4100

4200

4098'

4193'

1.20°

2.71°

162.79°

138.85°

4096.67'

4191.61'

21.68'

20.04'

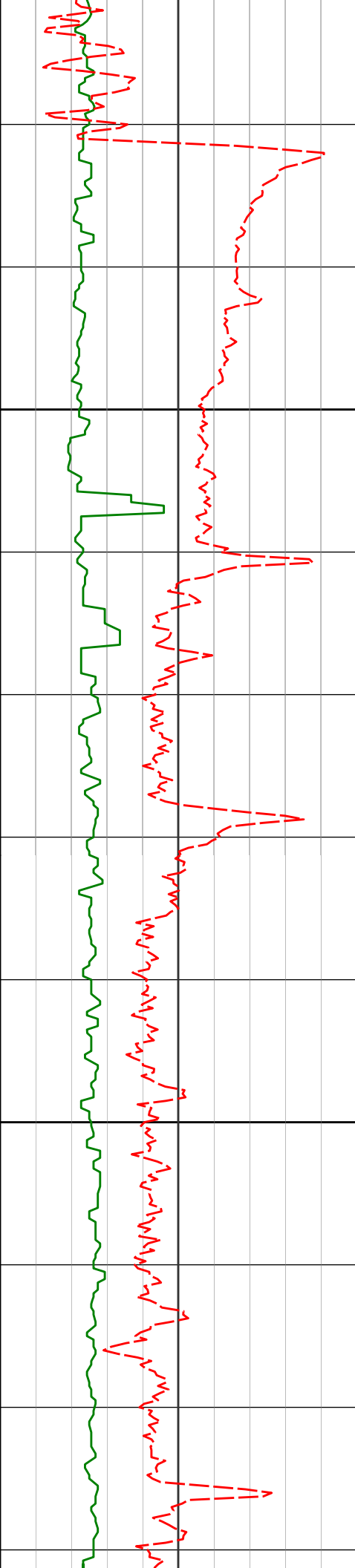
141.69°F

141.69°F

141.69°F

145.91°F

145.91°F



4300

4288'

1.91°

148.97° 4286.53'

17.89'

141.69°F

141.69°F

145.91°F

4400

4382'

0.81°

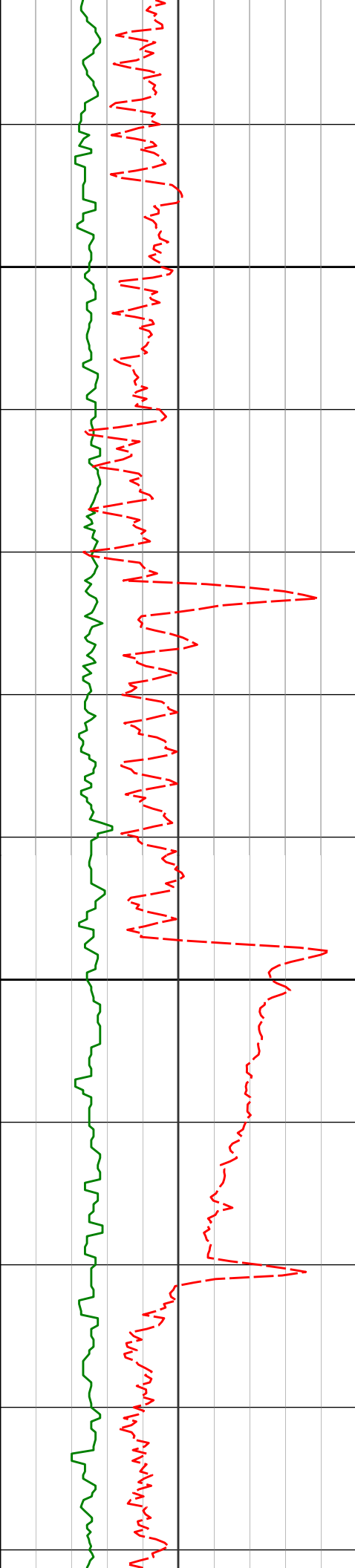
248.60° 4380.51'

17.77'

145.91°F

145.91°F





4500

4600

4477'

0.82°

270.71° 4475.50'

19.09'

145.91°F

145.91°F

4572'

2.31°

303.07° 4570.47'

21.32'

145.91°F

150.13°F

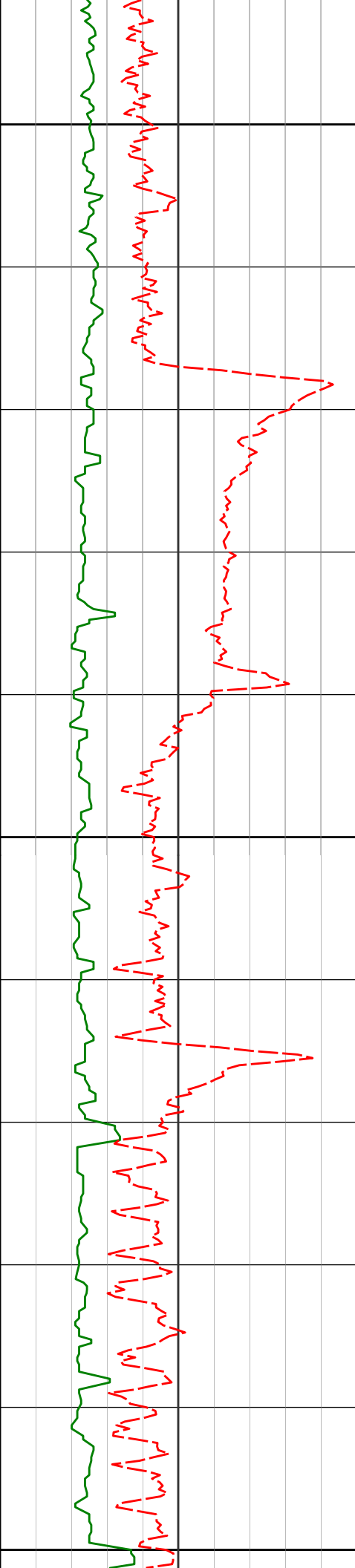
4666'

3.65°

250.69° 4664.35'

25.73'

150.13°F



4700

150.13°F

4761'

5.02°

223.44° 4759.09'

31.63'

150.13°F

4800

4855'

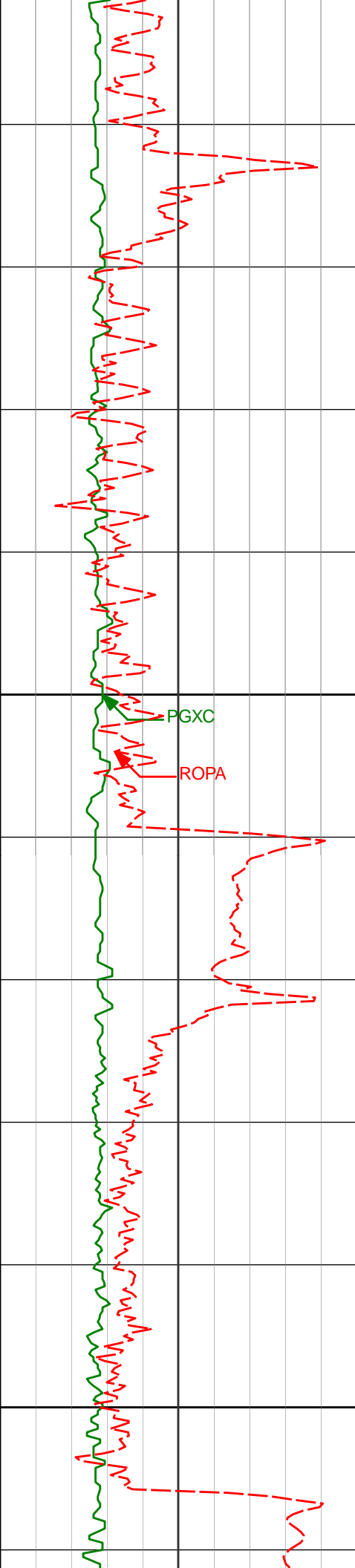
5.54°

219.04° 4852.69'

37.62'

150.13°F

4900



5000

5100

4950'

5.42°

220.22°

4947.26'

43.73'

154.34°F

154.34°F

5045'

5.39°

210.48°

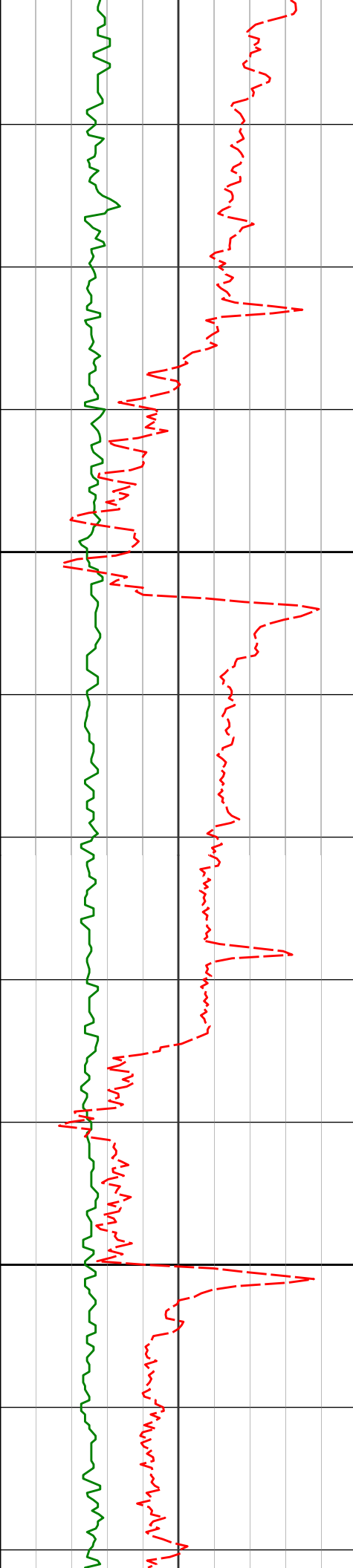
5041.83'

49.24'

150.13°F

150.13°F

150.13°F



5200

5300

5139'

6.36°

211.23° 5135.34'

54.56'

5234'

9.02°

214.48° 5229.48'

62.01'

5329'

8.56°

219.50° 5323.36'

71.27'

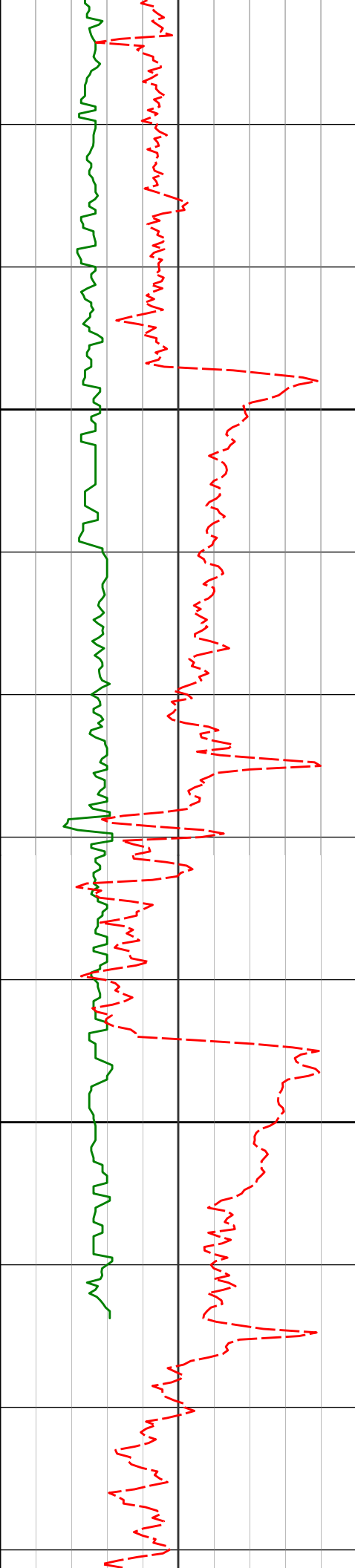
150.13°F

150.13°F

154.34°F

154.34°F

154.34°F



5400

5423'

9.65°

216.90°

5416.18'

81.00'

154.34°F

158.56°F

158.56°F

154.34°F

5500

5518'

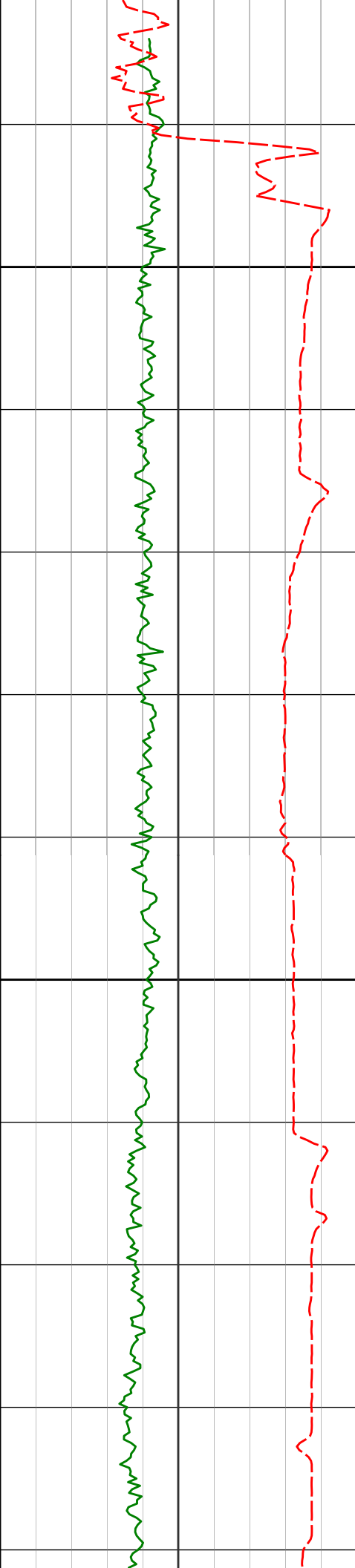
10.38°

227.01°

5509.74'

92.62'

154.34°F



Run 200  
5600

5606'

10.69°

232.08° 5596.25'

105.35'

143.60°F

143.60°F

140.00°F

5701'

14.91°

247.60° 5688.90'

124.07'

140.00°F

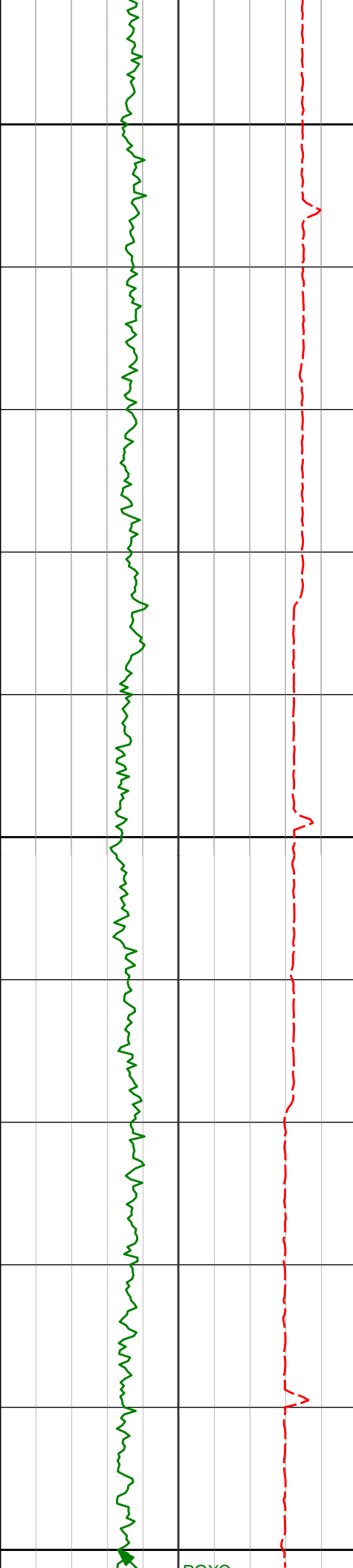
143.60°F

5796'

20.85°

253.13° 5779.28'

152.01'



5800

143.60°F

150.80°F

5890'

26.74°

251.20°

5865.25'

188.58'

150.80°F

5900

154.40°F

5985'

32.00°

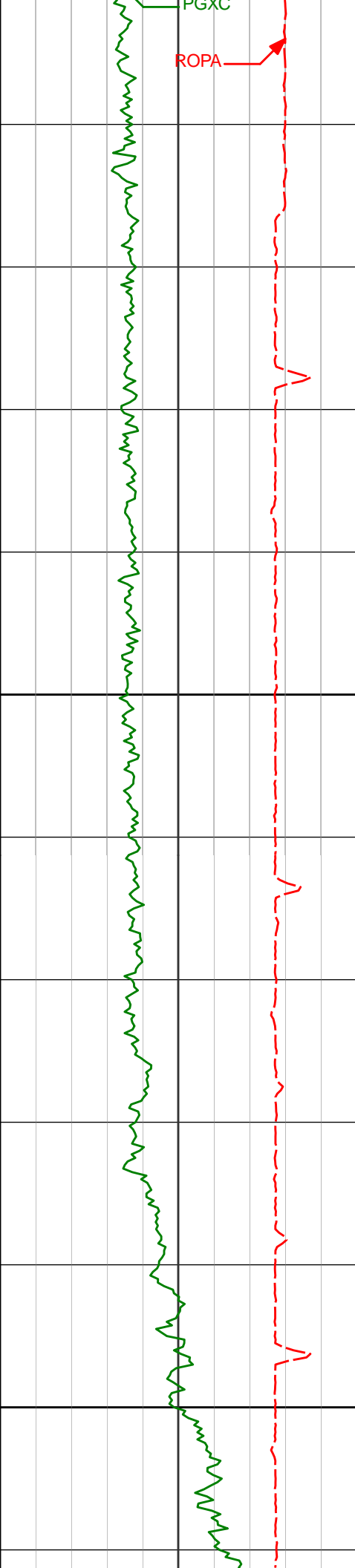
250.16°

5948.01'

233.21'

155.98°F

6000



6100

6200

6079'

6174'

6268'

36.69°

41.50°

47.18°

250.34°

250.25°

249.92°

6025.60'

6099.31'

6166.51'

283.92'

341.20'

403.95'

158.00°F

161.60°F

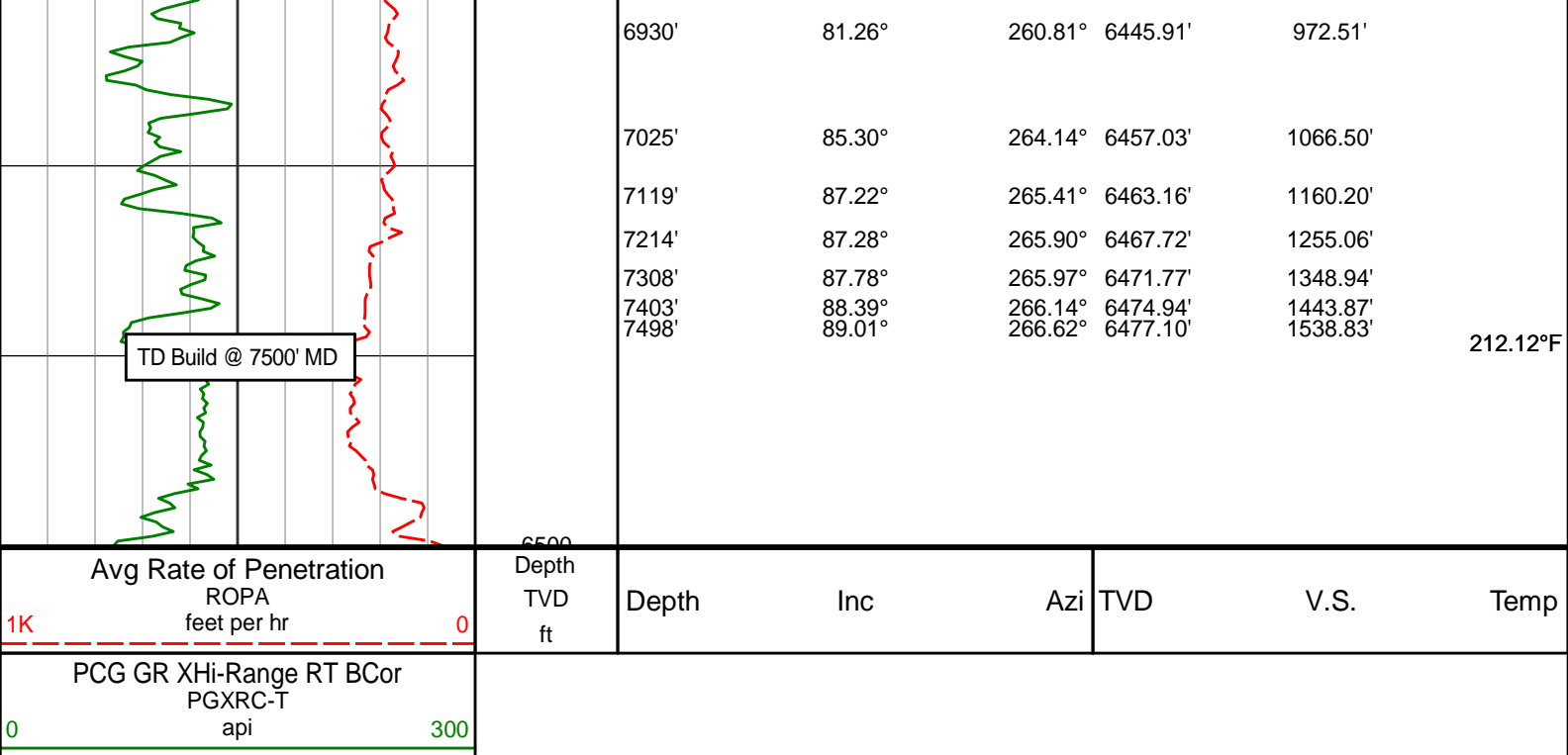
161.60°F

161.60°F

164.66°F







## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch BB01-615  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0903054511

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
84.00	0.15	263.81	84.00	0.01 S	0.11 W	0.11	0.18
178.00	0.10	331.05	178.00	0.05 N	0.27 W	0.27	0.15
273.00	1.30	286.31	272.99	0.42 N	1.35 W	1.32	1.30
367.00	1.03	275.51	366.97	0.80 N	3.21 W	3.17	0.37
462.00	1.11	287.56	461.96	1.16 N	4.94 W	4.88	0.25
556.00	0.89	317.28	555.94	1.97 N	6.30 W	6.20	0.59
651.00	0.43	253.07	650.94	2.41 N	7.14 W	7.02	0.84
746.00	0.81	270.04	745.93	2.31 N	8.15 W	8.03	0.44
840.00	0.46	344.04	839.93	2.67 N	8.92 W	8.78	0.87
935.00	0.18	44.51	934.92	3.14 N	8.92 W	8.76	0.42
1029.00	0.28	141.11	1028.92	3.07 N	8.68 W	8.52	0.37
1124.00	0.41	124.32	1123.92	2.70 N	8.25 W	8.11	0.17
1219.00	0.25	144.77	1218.92	2.34 N	7.85 W	7.73	0.21
1313.00	0.19	136.11	1312.92	2.06 N	7.62 W	7.51	0.07
1407.00	0.32	63.27	1406.92	2.06 N	7.28 W	7.17	0.34
1502.00	0.46	94.89	1501.92	2.15 N	6.66 W	6.55	0.26
1597.00	0.61	51.96	1596.91	2.43 N	5.88 W	5.76	0.44
1691.00	0.90	53.61	1690.90	3.18 N	4.90 W	4.74	0.31
1786.00	0.74	43.49	1785.90	4.06 N	3.87 W	3.67	0.23
1880.00	0.91	285.30	1879.89	4.70 N	4.18 W	3.95	1.51
1937.00	1.46	256.10	1936.88	4.65 N	5.32 W	5.09	1.40
2216.00	2.69	252.81	2215.69	1.86 N	15.02 W	14.92	0.44
2307.00	1.86	269.85	2306.62	1.22 N	18.54 W	18.46	1.17
2398.00	2.47	268.31	2397.55	1.16 N	21.97 W	21.89	0.67
2490.00	1.19	253.91	2489.51	0.84 N	24.86 W	24.79	1.46
2680.00	0.47	196.85	2679.49	0.46 S	26.98 W	26.97	0.53
2774.00	0.25	336.86	2773.49	0.64 S	27.18 W	27.18	0.72
2868.00	0.53	10.03	2867.48	0.02 S	27.18 W	27.15	0.37
2868.00	0.53	10.03	2867.48	0.02 S	27.18 W	27.15	0.37

2963.00	0.20	8.09	2962.48	0.57 N	27.08 W	27.02	0.35
3058.00	0.93	101.98	3057.48	0.57 N	26.30 W	26.25	1.02
3152.00	1.94	136.52	3151.45	0.74 S	24.46 W	24.47	1.36
3247.00	1.49	110.47	3246.41	2.34 S	22.20 W	22.29	0.93
3436.00	2.94	99.24	3435.26	3.98 S	15.10 W	15.28	0.80
3531.00	2.48	82.59	3530.16	4.11 S	10.66 W	10.84	0.96
3625.00	2.68	32.93	3624.07	2.00 S	7.45 W	7.54	2.31
3720.00	2.70	310.39	3719.00	1.32 N	7.95 W	7.87	3.74
3815.00	2.75	281.79	3813.89	3.23 N	11.88 W	11.71	1.42
3909.00	2.70	267.65	3907.79	3.60 N	16.30 W	16.11	0.72
4004.00	2.32	246.74	4002.70	2.75 N	20.30 W	20.14	1.03
4098.00	1.20	162.79	4096.67	1.05 N	21.75 W	21.68	2.66
4193.00	2.71	138.85	4191.61	1.59 S	19.98 W	20.04	1.77
4288.00	1.91	148.97	4286.53	4.64 S	17.69 W	17.89	0.93
4382.00	0.81	248.60	4380.51	6.23 S	17.50 W	17.77	2.34
4477.00	0.82	270.71	4475.50	6.46 S	18.80 W	19.09	0.33
4572.00	2.31	303.07	4570.47	5.41 S	21.09 W	21.32	1.76
4666.00	3.65	250.69	4664.35	5.37 S	25.50 W	25.73	3.08
4761.00	5.02	223.44	4759.09	9.39 S	31.21 W	31.63	2.56
4855.00	5.54	219.04	4852.69	15.89 S	36.90 W	37.62	0.70
4950.00	5.42	220.22	4947.26	22.88 S	42.68 W	43.73	0.17
5045.00	5.39	210.48	5041.83	30.15 S	47.84 W	49.24	0.97
5139.00	6.36	211.23	5135.34	38.41 S	52.78 W	54.56	1.04
5234.00	9.02	214.48	5229.48	49.05 S	59.73 W	62.01	2.84
5329.00	8.56	219.50	5323.36	60.65 S	68.44 W	71.27	0.94
5423.00	9.65	216.90	5416.18	72.35 S	77.62 W	81.00	1.24
5518.00	10.38	227.01	5509.74	84.56 S	88.67 W	92.62	2.00
5606.00	10.69	232.08	5596.25	94.98 S	100.91 W	105.35	1.11
5701.00	14.91	247.60	5688.90	105.06 S	119.17 W	124.07	5.69
5796.00	20.85	253.13	5779.28	114.63 S	146.67 W	152.01	6.50
5890.00	26.74	251.20	5865.25	126.31 S	182.73 W	188.58	6.32
5985.00	32.00	250.16	5948.01	141.75 S	226.67 W	233.21	5.56
6079.00	36.69	250.34	6025.60	159.66 S	276.58 W	283.92	4.99
6174.00	41.50	250.25	6099.31	179.86 S	332.96 W	341.20	5.06
6268.00	47.18	249.92	6166.51	202.24 S	394.70 W	403.95	6.05
6363.00	52.79	249.80	6227.57	227.28 S	462.98 W	473.35	5.91
6457.00	58.30	249.44	6280.73	254.27 S	535.61 W	547.19	5.87
6552.00	62.59	248.61	6327.58	283.86 S	612.74 W	625.66	4.58
6646.00	67.72	250.59	6367.07	313.55 S	692.67 W	706.92	5.78
6741.00	70.81	253.23	6400.70	341.11 S	777.12 W	792.59	4.16
6835.00	76.23	255.97	6427.36	365.01 S	863.98 W	880.50	6.41
6930.00	81.26	260.81	6445.91	383.71 S	955.20 W	972.51	7.28
7025.00	85.30	264.14	6457.03	396.05 S	1048.70 W	1066.50	5.50
7119.00	87.22	265.41	6463.16	404.59 S	1142.11 W	1160.20	2.45
7214.00	87.28	265.90	6467.72	411.78 S	1236.72 W	1255.06	0.52
7308.00	87.78	265.97	6471.77	418.44 S	1330.40 W	1348.94	0.54
7403.00	88.39	266.14	6474.94	424.97 S	1425.12 W	1443.87	0.67
7498.00	89.01	266.62	6477.10	430.97 S	1519.91 W	1538.83	0.83

**CALCULATION BASED ON MINIMUM CURVATURE METHOD**

**SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT  
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT**

**VERTICAL SECTION RELATIVE TO WELL HEAD  
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 267.25 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.30 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7498.00 FEET  
IS 1579.83 FEET ALONG 254.17 DEGREES (GRID)**